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ICT in pre-service teacher education in Portugal: trends and needs emerging from a survey

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Abstract

This paper reports the results of a survey made in 2003 that looked at all the Portuguese universities and schools of education (public and private) programmes for teacher education at least for one of the three levels primary, junior or secondary education. The aim was to get a picture of the situation regarding the amount of time used in training in ICT, the kind of resources available and used, the quality of the staff involved in this work and the competence of the student-teachers at the end of the programme from the point of view of the teachers responsible for the courses at each institution. The instrument used for this survey was the same as used in a previous study made in 1998 with the same aim in order to make possible to compare the results and analyse the trends.

Keywords

Pre-service teacher education; ICT in education; ICT competence

Introduction

The last twenty years saw an enormous evolution in the capabilities of ICT in terms of possibilities of communication and representation and this brought new ways of working in education that the institutions who are responsible for the preparation of teachers are trying to integrate, explore and expand. ICT has been both a field of study and an important dimension in teacher education in Portugal. However, there is a lack of understanding about the role given to ICT in the pre-service education and in particular about the ways how students integrate or not their preparation on ICT in their daily teaching practices once they get into the profession. This is recognized as a field deserving much attention from the part of researchers and it is one of the reasons why the Portuguese Ministry of Education appointed a team in 1998 to begin analysing the situation starting from the voice of the institutions who prepare the teachers. This gave birth to a study ([DAPP, 1998](#)) that showed a rather optimistic picture of the preparation of the Portuguese student-teachers in ICT. In 2004 the Ministry of Education decided to develop a follow-up study in order to assess the evolution of the preparation of the teachers in pre-services programmes. This study was coordinated by the author of this paper and presented to the Ministry of Education in July 2004 ([DAPP, 2004](#)).

Rationale

It is common to recognize that nowadays many of the young people who enrol in teacher education programmes in universities and schools of education have a daily practice in the use of sophisticated technological instruments – such as computers, game boxes, mobile phones, audio and video systems, etc. However, it is not clear that those students have developed skills in reflecting on the ways technology in general (and ICT in particular) can be used as mediating tools for education nor a critical perspective about the use of those technologies and a reflection about the way ICT is formatting the social world. Therefore, in assessing the views of the institutions about the competence of their student-teachers in ICT we have to consider not only the dimension of competence in the use of ICT in personal activities but also the competence in reflection about its use in education and in society.

Those are some of the reasons that made particularly relevant to study how teacher education programmes address the training in the use of ICT – in particular in education. Although we assume the understanding that there is a distance between the pre-service teacher education provided to student-teachers and the ways those teachers will develop their practices in the classroom, it is essential to understand better the perspectives of the institutions and the educators and their efforts in trying to develop a dimension of ICT in the prospective teachers' preparation.

Methodology

The survey addressed all the Portuguese institutions that have teacher education programmes – from kindergarten to secondary education – and aimed to get a picture of the situation from the perspective of the institutions and compare that picture to the one

of the 1998 study. In order to make possible to compare the results, the instrument used to collect data and the forms of analysis developed in this study were similar to the previous study.

The population for this survey was defined as all the institutions (universities and schools of education, both private and public) and all the pre-service teacher education programmes in Portugal. The questionnaire prepared to collect data included two Parts: Part I was dedicated to collect data about the institution, number of teachers involved in teaching, resources available, etc, and was expected to be filled by the head of the institution. Part II addressed the specific teacher education programmes of the institution and should be filled by the head of the department responsible for the programmes.

As expected, there is a number of institutions who did not reply to the questionnaires. We consider the sample of the study as the institutions who replied to the questionnaire as described in Table 1:

Table 1.: Number of institutions included in the Sample

	University Public	Polytechnics Public	University Private	Polytechnics Private
Total of existing institutions	22	15	6	14
Institutions in the sample – Part I	20	9	4	13
Institutions in the sample – Part II	17	7	2	13

Table 2 shows the number and distribution of teacher education programmes according to the type of institution:

Table 2.: Programmes included in the Sample according to the type of institution

(some of the programmes cover more than one teaching level)

	University Public	Polytechnics Public	University Private	Polytechnics Private
Total of existing Programmes	108	69	10	66
Kindergarten	5	7	0	8
Primary (grades 1-4)	4	19	0	33
Preparatory (grades 5-6)	4	23	0	27
Junior High (grades 7-9)	33	0	2	0
Secondary (grades 10-12)	40	0	2	0
Total of Programmes in the sample	49	38	2	45

The sample represents about 50% of the existing programmes in the universities and 55% in the case of the public polytechnics. In the case of the public universities the sample covers 68% of the existing programmes but in the case of the private universities this number is 20%. These numbers were considered good when compared with those used in the 1998 study (around 30% of the programmes). However, as we have no possibility to know if we are referring to the same programmes this should be taken in consideration when appreciating the results of this study. Together with that precaution, we should note that the raising of the number of institutions dedicated, for example, to elementary teacher education in the last 10 years made an increase of the number of teacher education programmes in that level from 20 in 1998 to 45 in 2003. This variation can interfere when we compare the results of the two studies.

As referred, the survey was based on a questionnaire that included two Parts. The questionnaires were sent to the institutions with a covering letter aiming to explain the importance of the study and the procedures to fill it. An electronic version of the questionnaire was published in a website and a code was given to each institution in case they prefer to fill it on-line. Around 80% of the institutions in the sample used the on-line version of the questionnaire,

Data was analysed using basic statistics on SPSS.

Results

The results of the study are presented in two parts. First, it is presented a picture of the institutions and afterwards a description and analysis of the teacher education programmes and the voice of the teachers about the preparation student-teachers get in the programmes.

The institutions

As part of the survey, the institutions were asked about physical infrastructures for the use of teaching of ICT. Only 3 out of 20 public universities, and one in 4 in the private ones, declared that they don't have a Centre devoted to ICT. In the schools of education in the Polytechnics all the 9 public and 10 of the 13 private have a Centre for ICT (see Table 3).

Table 3. Physical structures for ICT. Number of institutions having a Centre for ICT

	University Public	University Private	Polytechnics Public	Polytechnics Private
Centre for ICT	16	3	9	10
Resource Centre	13	3	9	10
Department of Informatics (as an individual entity)	13	2	8	

These numbers show how important the institutions consider ICT. But we should note that only 50% of the Centres for ICT have direct intervention in the teacher education programmes, the exception being the private Polytechnics where all of them have that kind of Centre devoted to the pre-service programmes.

Comparing to the 1998 results we have a rather big increase in the number of institutions that decided to create their own department of Informatics as an independent entity (62% in the universities and 68% in the case of the Polytechnics, against about 30% in 1998). Although this situation can be read as a positive evolution, we need to know in more detail the physical dimension and the latitude that the institutions use to classify their resources as a Centre for ICT, a Resource Centre or a Department of Informatics.

The resources are used by student-teachers in a variety of forms and in a variety of schedules. Tables 4, 5 and 6 give a picture of the intensity of use, the availability of resources and the quantitative relation computers/students.

Table 4. Average time in hours/week that students use the resources in each type of institution

	University Public	University Private	Polytechnics Public	Polytechnics Private
Average time the resources are used	45	43,3	46	49,8

Table 5. Resources to support the use of ICT: number of computers with Internet connection

	University Public	University Private	Polytechnics Public	Polytechnics Private
Average number of computers for classes	192	252	31,8	26,8
Average number of computers for free use	157	233	19,5	15,3

Table 6. Average number of computers by student

	University Public	University Private	Polytechnics Public	Polytechnics Private
Average number of computers by student	0,07	0,07	0,05	0,04

These numbers show that all the institutions have resources for the use of computers both for teaching and for free use by students. The number of computers certainly depends on the dimension of the institution although it is clearly smaller in the case of

the Polytechnics (both private and public). It is important to know that the numbers in Table 6 when translated against the number of students in each type of institution give about 14 students for each computer in the case of the universities and 25 for the Polytechnics. Unfortunately this kind of results is not available in the 1998 study so no comparison is possible.

Human resources

One of the key issues in the evaluation of the effort that institutions make in the education on ICT has to do with the number of teachers and the kind of degree they hold and their academic background. Tables 7 and 8 allow us to have a picture of that and compare it with the 1998 study.

Table 7. Number of teachers with background in didactics teaching ICT and ICT use in education
(in parentheses, the results from the 1998 study)

	University Public	Polytechnics Public	University and Polytechnics Private
PhD	52 (36)	12 (4)	10 (5)
Master	21 (19)	30 (32)	69 (20)
Degree Licenciatura*	4 (16)	14 (23)	29 (12)
Degree Bacharelato*	2 (0)	0 (4)	1 (0)
Total	79 (71)	56 (63)	109 (37)

* In Portugal Licenciatura corresponds to a 4 or 5 year programme and Bacharelato is a 3 years programme.

Table 8. Number of teachers with background in didactics teaching ICT and ICT use in education against the number of students that finished the programme in 2003 (in parentheses, the results from the 1998 study)

	University Public	Polytechnics Public	University and Polytechnics Private
PhD	0,027 (0,037)	0,017 (0,009)	0,007 (0,012)
Master	0,011 (0,020)	0,042 (0,076)	0,049 (0,047)
Degree Licenciatura	0,002 (0,017)	0,019 (0,054)	0,020 (0,030)
Degree Bacharelato	0,001 (0)	0 (0,09)	0 (0)
Teacher by student	0,041 (0,074)	0,079 (0,147)	0,078 (0,086)

These results show that it seems to have diminished since 1998 the number of teachers holding a PhD in the area of Didactics in the public universities but we should note that the number of universities that are in the sample of this study is the double of the number in the sample in 1998. This can hide asymmetries in the decision to reply to the questionnaires that we are not able to control in this analysis. However, it is clear the

investment made by the Polytechnics since 1998 as the number of teacher per student show.

Regarding the teachers with a general background in education the results show that the number of teachers holding a PhD or a Master increased in a rather significant way in all the types of institutions (see Table 9). This can be interpreted both as a sign of investment from the part of the institutions and as a measure of the increasing importance of the area of ICT in education. Table 10 shows that not only the number of teachers increased but that the ratio teachers/students also increased significantly.

Table 9. Number of teachers with general background in education, teaching ICT and ICT use in education

(in parentheses, the results from the 1998 study)

	University Public	Polytechnics Public	University and Polytechnics Private
PhD	23 (3)	4 (1)	14 (8)
Master	9 (5)	13 (6)	57 (16)
Degree Licenciatura	7 (4)	6 (4)	53 (10)
Degree Bacharelato	0 (0)	0 (4)	0 (2)
Total	39 (12)	23 (11)	124 (36)

Table 10. Number of teachers with general background in education, teaching ICT and ICT use in education against the number of students that finished the programme in 2003 (in parentheses, the results from the 1998 study)

	University Public	Polytechnics Public	University and Polytechnics Private
PhD	.012 (.003)	.006 (.002)	.001 (.019)
Master	.005 (.005)	.018 (.014)	.004 (.037)
Degree Licenciatura	.004 (.004)	.008 (.009)	.037 (.023)
Degree Bacharelato	.000 (.000)	.000 (.000)	.000 (.005)
Teacher by student	.020 (.012)	.032 (.026)	.088 (.084)

It is common sense to say that in all levels the quality of the human resources is a quite relevant factor to produce teachers with a solid preparation in the use of ICT in education. But we should stress here that the numbers shown in this study point to the recognition of the role of universities and Polytechnics in this area.

Globally we can conclude that the institutions that have the responsibility of preparing future teachers have the resources, both physical and human, to do their job.

The role of ICT in the teacher education programmes

Part II of the questionnaire included a survey of the programmes that the institutions are running. One of the ways to assess the importance given by the institutions to the education in the use of ICT is to observe the number of credits devoted to that area. In this analysis, in order to guarantee the possibility of comparing to the results of the 1998 study, two groups of disciplines were considered: a first group including the disciplines that are specific and dedicated to the study and training in ICT and a second group with the disciplines that make relevant use of ICT or focus on the use of ICT in education. Table 11 shows the average distribution of the numbers of credits attached to the disciplines in the programmes and it is very clear that there is a break of 50% in the Polytechnics and in the private sector. Only the public universities show a small increase in the effort made in this domain of the curriculum. All the institutions seem to be more concerned with the use and reflection about ICT in education than for the more technical aspects of ICT – following the same trend identified in 1998 – but it is apparent a reduction in the number of credits.

Table 11. Average number of credits of the disciplines dedicated to ICT, and using ICT or reflecting on ICT in education (average number of credits by programme). In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
Disciplines dedicated to ICT	4.4 (2.7)	2.5 (5.7)	3.7 (6.6)
Other disciplines using ICT or reflecting on ICT use in education	4.9 (4.0)	4.3 (12.4)	5.2 (13.8)

In order to get a clearer Picture, Table 12 shows the weight of the different disciplines against the type of programme.

Table 12. Average number of credits of the disciplines dedicated to ICT, and using ICT or reflecting on ICT in education against the type of programme. In parentheses the results from 1998 study.

	Kindergarten and Primary (grades K-4)	Junior high and secondary (grades 5-12) Mathematics and Science	Junior high and secondary (grades 5-12) Humanistic	Other
Disciplines dedicated to ICT	2.5 (2.8)	3.5 (8.6)	3.3 (2.1)	2.9 (4.8)
Other disciplines using ICT or reflecting on ICT use in education	6.3 (5.7)	4.2 (19.5)	5.7 (3.8)	6.3 (5.5)

The study developed in 1998 suggested a need to increase the total number of credits of the disciplines that make extensive use of ICT or reflect on ICT in education. Five years after that, the situation in the public universities didn't change significantly but in the other types of institutions the concern with ICT seems to have diminished. One interpretation could be that many institutions could be assuming ICT now as part of the everyday of students (doing word processing, searching the web, doing instant messaging and e-mail, playing computer games, etc) and therefore concluding that there is no need to put a great effort on ICT for the students. It is clear that we need to learn more about this situation in order to conclude what needs do students have in terms of ICT.

Looking at the number of credits in the different domains of the teacher education programmes we can see that the time dedicated to ICT in Mathematics and Science is now less than in 1998. This inversion seems to be contradictory with the common discourse claiming that those are the areas where ICT would be more easily used in primary and secondary schools.

In summary, we observe that the dimension of ICT in the teacher education programmes is now less visible than in 1998 specially in the public Polytechnics and in the private institutions. In parallel we have now a quite significant reduction of the time allowed for education in ICT in Mathematics and Science.

Students' competence in ICT

It is important to know how the institutions perceive their role and efficiency in preparing student-teachers in ICT. The questionnaire designed for this study included a scale with four points: None, Fair, Good, Excellent. Because the 1998 study grouped these four categories in two (on one side Good and Excellent and on the other side None and Fair) we are doing the same in this study although we have the full distribution of answers.

i) competence in word processing

Table 13. Competence of the student-teachers in the use of word processing by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	2% (22%)	0% (12%)	0% (13%)
Good or Excellent	98% (53%)	100% (79%)	100% (83%)
No answer	0% (25%)	0% (6%)	0% (4%)

It is notorious the satisfaction of the institutions in what concerns the skills obtained by their students and this is in line with the results of the 1998 study.

The use of e-mail is another indicator of the competence of the student-teachers and the degree of integration in their daily lives. Here the results of this study suggest a rather different situation when compared to 1998. As we see in Table 14 almost all the institutions see the competence of the students as Good or Excellent.

Table 14. Competence of the student-teachers in the use of e-mail by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	4% (43%)	5% (62%)	0% (83%)
Good or Excellent	94% (24%)	95% (18%)	100% (13%)
No answer	2% (33%)	0% (21%)	0% (4%)

These results are consistent with those referring to the use of the Internet by the student-teachers. It is important to note that the differences seen in Table 15 when comparing to 1998 (where the number of no answer is quite significant indicating probably difficulties or even no access to the internet) are for sure a consequence of the present availability of the internet in most institutions.

Table 15. Competence of the student-teachers in the use of the internet by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	0% (38%)	5% (61%)	0% (82%)
Good or Excellent	100% (29%)	95% (21%)	100% (9%)
No answer	0% (33%)	0% (18%)	0% (9%)

Given that the access to the Internet saw a huge increase in the last few years in Portugal, this certainly transformed the situation from 1998. Nowadays the issue is not access or the technical aspects of the Internet, but more important issues such as the quality of the use of Internet by the student-teachers, the ethical issues involved in the resources available on the web, the sensibility of the student-teachers in assessing permanently and systematically the information gathered, etc.

The institutions were also asked about the competence of the student-teachers in the use of data basis. As we see on Table 16 the results show some difficulties in this specific domain, the percentage going from 11% to 53% for a Good or Excellent performance. The results for the use of data basis were already considered bad in 1998. It is possible that new applications and automatic search (not only on the web) contributed to reduced

the need felt by the users to go deeper in knowing about data basis and data management. In parallel we should note that data basis are easily integrated in several areas of study in primary and secondary schools with no great need of knowledge about the applications themselves.

Table 16. Competence of the student-teachers in the use of data basis by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	69% (49%)	89% (59%)	47% (70%)
Good or Excellent	25% (14%)	11% (15%)	53% (17%)
No answer	6% (37%)	0% (26%)	0% (13%)

In the use of software for presentation (such as PowerPoint) the evolution from 1998 is enormous pointing now to 84 to 100% as Good or Excellent performance against 46% and 34% five years ago. Even so we must note that 16% of the answers mark the competence of student-teachers in public Polytechnics as None or Fair (see Table 17).

Table 17. Competence of the student-teachers in the use of software for Presentation (PowerPoint type) by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	4% (46%)	16% (47%)	0% (34%)
Good or Excellent	94% (21%)	84% (32%)	100% (65%)
No answer	2% (33%)	0% (21%)	0% (4%)

The competence of the student-teachers in the use of Statistics Packages is considered by the institutions as very weak – going from 90% rating None or Fair in the private universities and Polytechnics to 65% and 76% in the public universities and Polytechnics as shown in Table 18.

Table 18. Competence of the student-teachers in the use of Statistics Packages by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	65% (55%)	76% (65%)	89% (70%)
Good or Excellent	29% (14%)	24% (18%)	11% (29%)
No answer	6% (31%)	0% (18%)	0% (4%)

It is apparent that the situation got worst since 1998. And we can ask ourselves if these results are more a consequence of the lack of preparation of the students in Statistics and not only a lack of competence in the use of the software.

Regarding the competence of the student-teachers in programming languages the results point to a change that can be interpreted as a more and more lack of interest in programming given the type of computer applications available. The public universities are those who maintain some interest in this topic with a percentage of 27% showing a Good or Excellent competence. Although the results being in line with those of 1998 (see Table 19) we should refer that the notion of programming language has seen an evolution and probably people have now more difficulties in identifying what it means to programme (see the case of Basic against ToonTalk).

Table 19. Competence of the student-teachers in computer programming languages by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	67% (55%)	92% (74%)	98% (87%)
Good or Excellent	27% (18%)	5% (15%)	2% (4%)
No answer	6% (27%)	3% (12%)	0% (8%)

The use of ICT in teaching is considered as Good or Excellent by most of the institutions in the sample, the differences from 1998 being maybe due to the lack of answers five year ago (see Table 20). However, the differences from 1998 seem to indicate a positive evolution.

Table 20. Competence of the student-teachers in the use of ICT in teaching by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	8% (27%)	21% (29%)	0% (13%)
Good or Excellent	84% (45%)	79% (56%)	96% (74%)
No answer	8% (29%)	0% (15%)	4% (13%)

When asked about the competence of the student-teachers regarding the social and ethical implications of the use of ICT, the results obtained are hard to interpret (see Table 21).

Table 21. Competence of the student-teachers in the reflection of the social and ethical implications of the use of ICT by the end of the programme according to the opinion of the teachers. In parentheses the results from 1998 study.

	University Public	Polytechnics Public	University and Polytechnics Private
None or Fair	30% (33%)	34% (47%)	2% (31%)
Good or Excellent	62% (33%)	66% (41%)	98% (65%)
No answer	8% (34%)	0% (12%)	0% (4%)

On one side, one third of the public universities and Polytechnics point to a weak preparation of the student-teachers in reflecting on the social and ethical issues of the use of ICT but this percentage goes to 2% for the private institutions thus 98% of them claiming that students are good or excellent in that item. These differences may be due to the type and level of teacher education programmes as we have indications that those preparing for kindergarten and primary are more concerned with social implications and ethics. We certainly have to critically ask ourselves about the meaning that the institutions gave to the idea of “social implication of the use of ICT”.

Discussion and recommendations

This survey addressed the perception that the institutions have about the competence of the student-teachers in the teacher education programmes. It was possible to construct a picture showing the situation as it is seen by the teachers in the institutions and compare some of the data obtained with those collected in 1998.

The analysis of the data collected showed evidence that point to a number of results and recommendations, in the areas of (i) the role of ICT in pre-service teacher education (showing difficulties of integration and a small number of credits), (ii) the resources available and the critical needs of training of the teachers of the universities and schools of education, (iii) the narrow scope of the training that student-teachers seem to have at the end of the programme, and (iv) the need for further studies that allow us to learn in more detail the ways teachers are educated on ICT.

(i) First, we acknowledge that the presence of ICT in the teacher education programmes is a fact – both in an explicit form in disciplines dedicated to more technical aspects and in disciplines aiming to learn about the use of ICT in education. However, we identify two problems here: (i) there is some difficulty in integrating ICT in the curriculum of the programmes, and (ii) the number of credits is considered small. The first issue has to do with the difficulty of conceiving ICT as tools available when needed. For this to happen teachers at universities and Polytechnics should be immersed in a culture that values ICT in their daily practices. It seems that student-teachers use ICT in the production of documents for a variety of disciplines but the integration of ICT in the activities of the disciplines is not a reality. The second issue suggests that the time and effort devoted to ICT is not enough. This need should be considered with caution in order not to change an equilibrium between a technical and a pedagogical dimension of the preparation on ICT.

Thus, the recommendation points to the need that the institutions responsible for the teacher education programmes look at strategies of raising the time and effort devoted to the training of students on ICT keeping in mind the crucial importance of integration of a technical dimension with a pedagogical dimension.

(ii) A second issue refers to the resources. This study confirms a trend already known in terms of the better and better quality of the physical resources of the institutions making a huge difference from the situation in 1998. However, there is a number of institutions that need to get better physical resources – namely in terms of space and computers. For the human resources the number and academic background of teachers devoted to the education of student-teachers on ICT seems to be rather good. The qualitative part of the study (reported in detail in [DAPP, 2004](#)) shows that the situation can soon be critical regarding the feeling that the preparation of those teachers is not enough (meaning that the fact that they hold a Master or PhD is not an indicator of the quality of their teaching).

The recommendation that emerges from this is that the institutions consolidate their faculty trying to identify their teachers' needs in terms of preparation and act accordingly to allow the teachers to get the preparation they feel they need.

(iii) For the competencies showed by the students at the end of the programme the institutions consider that it is in general good. But this happens mainly on the technical aspects such as using word processing, using e-mail, etc, pointing to a very limited daily use by the student-teachers. Other areas of competence in the field of ICT and ICT use in education and in society seem to show weaknesses that should be corrected. Thus, the study recommends that the institutions should seek to identify in detail the way their student-teachers use ICT in order to open other avenues and help the development of their competence on ICT.

(iv) This study acknowledges its own limitations coming from the kind of instruments used and the difficulties in getting information complete from the institutions. Because the quality of the teacher education programmes is a key issue in terms of improving the quality of teaching in primary and secondary schools, it is crucial to go deeper in the

analysis of the practices going on in those programmes. It is not enough to have a broad picture of the situation, there is a need to know in detail the forms that the preparation of teachers is taking. Therefore, the recommendation goes for a broad set of institutions (including the institutions that run the programmes, the research funding institutions and the Ministry of Education) in order to create conditions that promote the development of further studies that allow the universities and Polytechnics to have a more real picture of the way teachers are being educated on ICT in Portugal.

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